THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

January 13, 2006 File: 15-85-13

Alberta Infrastructure and Transportation
3rd Floor, Provincial Building
9621 – 96th Avenue
Peace River, Alberta T8S 1T4

Attention: Mr. Ed Szmata

PEACE REGION (PEACE RIVER/HIGH LEVEL) LANDSLIDE ASSESSMENT
HWY 88:18 CULVERT REPLACMENT NEAR FT. VERMILION - PH16
NORTHEAST QUADRANT SLOPE INSTABILITY

Dear Sir;

This letter documents a site inspection undertaken by Thurber Engineering Ltd. (Thurber) for the above referenced site located on Hwy 88, approximately 2.5 km west of Fort Vermilion, Alberta. The work was undertaken by Thurber Engineering Ltd. (Thurber) under the terms of our Geotechnical Services, Monitoring and Assessment of Instrumentation and Landslides contract with (CE 049/2004) Alberta Infrastructure and Transportation (AIT).

The inspection was undertaken on June 20, 2005 by Mr. Don Proudfoot, P. Eng and Mr. Vedran Bijeljanin, E.I.T. of Thurber in the presence of Mr. Ed Szmata, Ms. Amanda Russell and Mr. Roger Skirrow, P. Eng. of AIT.

1. BACKGROUND

The project consisted of replacing an existing culvert with a 3.05 m diameter, 90 m long CSP culvert with the majority of the work undertaken in the Fall of 2003. Background regarding slope failures and mitigative measures undertaken during construction was provided in a letter dated June 11, 2004. which documented a site visit undertaken on June 4, 2004, by Mr. Don Law. P.Eng of Thurber. The letter report provided recommendations for slope flattening, subdrains and erosion protection. Additional recommendations regarding site drainage and erosion protection were provided in the 2004 Landslide Assessment Report dated November 24, 2004.

This letter report should be read in conjunction with the June 11th and November 24th, 2004 letter reports.

2. SITE OBSERVATIONS

The borrow pit area, culvert and side slopes were inspected during the site reconnaissance. The site conditions at that time are shown on the attached site sketch plan. Selected photographs of the site taken on June 20, 2005 are also attached.

At the time of the site visit, the construction at the site was completed. The vegetative cover on the east side slope was sparse leading to slope erosion. A number of minor erosion gullies (approximately 0.6 m wide and up to 0.5 m deep) were noted along the east slope. In general the east slope was drier than last year, however, a wet area, containing saturated flowing silts, was noted in the north-west corner near the toe of the slope. This area measured 5 m by 8 m and was about 1 m deep.

At the time of the site visit noticeable silt accumulation was observed at the culvert outlet.

The south-east drainage ditch lined with geotextile and rip rap was not showing any signs of deterioration. A good vegetative cover was noted on the north-west "V" ditch, which was generally in a good condition, except for a 1 m long and 0.3 m deep erosion gully located approximately half way up the slope.

The borrow pit area did not contain any significant wet areas or free standing water.

Soil erosion and a minor erosion triggered slump were noted above the rip rap level on the east side of the culvert inlet. A minor sink hole in the highway side slope was observed east of the borrow pit area.

3. RECOMMENDATIONS

The mitigation measures implemented to stabilize the east slope appear to be working. The slope seemed to be stable and did not show signs of tension cracking of slope movement. However, due to poor vegetative cover, surface erosion was evident. In order to provide erosion protection the east slope should be double seeded to ensure sufficient grass coverage. Wattles (BMP #28b) should be installed along the erosion gullies to prevent further slope erosion and the gullies should be backfilled with soil. Additional seeding and installation of wattles would constitute a short term solution. A long term solution would involve re-grading the east slope, and creating three flat benches across the slope, which

would intercept and redirect the surface runoff to the nearby swale. The re-graded slope should be covered with straw matting (low flow soil covering) and seeded.

The wet unstable area, located in the north-west corner of the east slope, should be subexcavated and replaced with clean granular backfill underlain by geotextile.

A 1 m long erosion gully located in the north-west swale ("V" ditch) should be backfilled with gravel to prevent from further erosion in the area. As the vegetative cover along the north-west swale is showing good growth no further action is recommended.

The accumulated silt at the culvert outlet should be removed and used to backfill the sink hole, noted in highway side slope east of the borrow pit area.

It is recommended that the rip rap covering at the culvert inlet be repaired around the perimeter. The area should be cleaned up, followed by placement of geotextile, pit run gravel, and heavy rip rap. If the ditch berm west of the culvert inlet is damaged during construction, it should be rebuilt upon placement of rip rap to ensure proper ditch drainage.

The ballpark cost for the above short term "maintenance" measures is approximately $15,000. The additional ballpark cost for long term measures to bench, protect and re-seed the east slope is about $30,000.

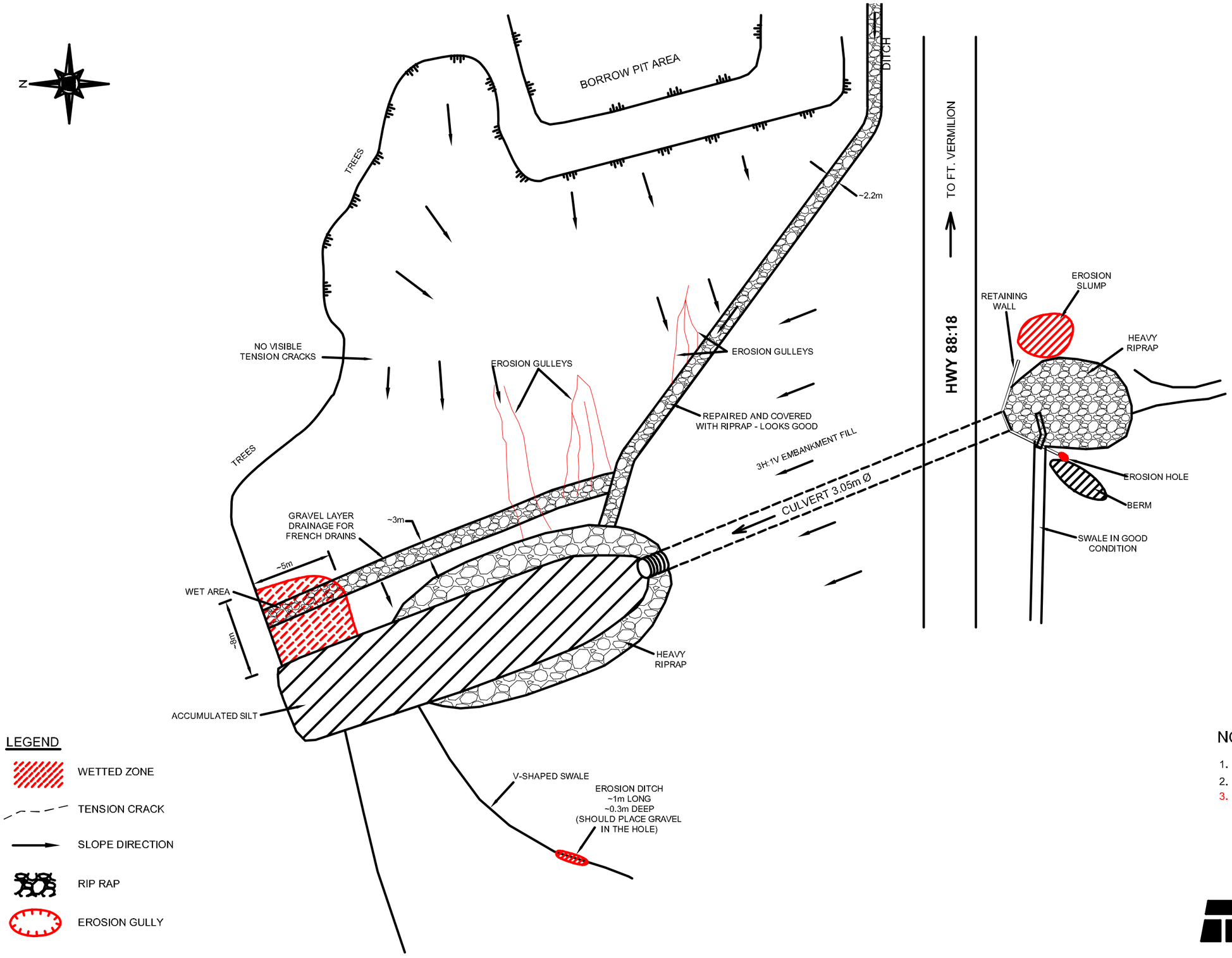
4. CLOSURE

We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions or concerns arise.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, P.Eng.
Review Principal

Vedran Bijeljanin, E.I.T.
Project Engineer

/mes



LEGEND

- WETTED ZONE
- TENSION CRACK
- SLOPE DIRECTION
- RIP RAP
- EROSION GULLY

0 5 10 15 20 25

SCALE (m)

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. JUNE 2005 OBSERVATIONS SHOWN IN RED

FIGURE PH16-1

HWY 88:18 FORT VERMILLION

SITE SKETCH PLAN

DATE : JULY, 2005

THURBER PROJECT #15-85-16

THURBER ENGINEERING LTD.

GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

PHOTO 1: Borrow pit area

PHOTO 2: Inlet of the borrow pit drain pipe

PHOTO 3: Erosion gullies on the east slope

PHOTO 4: Wet area in the northwest corner of the east slope

PHOTO 5: Overall view of the east slope

PHOTO 6: Erosion damage at the culvert inlet